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Better Environmental Value Using Public Procurement: Evidence from Visegrad Group Countries

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Abstract

The perception of public procurement has changed over the last decade and gained the role of a strategic tool for achieving sustainable and inclusive growth goals. Environmental considerations in procuring goods, services, and works thus help promote sustainability goals and obtain better environmental value using public funds in the long term perspective. This paper analyses selected determinants' impact on green criteria to award public contracts in the Visegrad Group countries. Using content and regression analysis on an extensive dataset of contract award notices published in Tender Electronic Daily in 2017-2019, we show that green criteria are more prominent in contracts awarded by regional and local contracting authorities, confirming their significant role in fulfilling sustainable development goals on a local and regional level. On the other hand, the relatively low uptake of green award criteria suggests a somehow reserved attitude of contracting authorities towards promoting the environmental requirements by awarding contracts based on the most economically advantageous tender.

1. Introduction

Increasingly, it is possible to witness destructive weather events, whether in global warming, devastating storms and subsequent floods, or large-scale fires resulting from ever-accelerating changes in the environment. Although environmental protection in society has resonated for several years, it has gained importance and attention in the last decade at a swift pace. Environmental protection occurs in regulations and directives or other policy instruments regulating production, consumption, carbon footprint reduction, or carbon neutrality at the macro level. Environmental protection activities on the micro-level include waste separation, conscious consumption, and individuals' efforts to produce as little waste as possible.

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The acquisition of goods, services or works using public procurement is a key economic activity of public authorities, which spend more than 14% of EU GDP (Brammer & Walker, 2011a; European Commission, 2017; Grandia, 2015). The enormous purchasing power on the demand-side thus making of public procurement a strategic tool to promote policy goals toward sustainable and inclusive growth (OECD, 2011a; United Nations, 2008). In other words, public procurement can shape production and consumption patterns, providing innovation incentives on the suppliers' side to develop environmentally friendly technologies. The concept of procurement, through which government authorities can obtain environmentally friendly products and services by spending taxpayers' money, is referred to as green public procurement (GPP). GPP is defined as "a process, whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured (European Commission, 2008). GPP thus aims to obtain the best environmental quality products or services for taxpayers' money using the procurement rules.

The EU public procurement directives adopted in 2014 facilitate the environmental integration in various stages of the procurement process, including the environmental requirements, the use of environmental labels criteria, or the allowing to take into account the environmental aspects in the production process and life-cycle analysis (European Commission, 2014, as cited in Pouikli, 2020). Despite efforts at the European level to promote environmental aspects in public procurement, public authorities' uptake of green considerations in their purchases varies across the EU (Diófási & Valkó, 2014; Renda et al., 2012). Although recent research focuses on the various determinants influencing GPP adoption across the EU (e.g., Rosell 2021, Yu et al., 2020), a more detailed overview of specific regions comprising politically and economically similar countries is still lacking.

Therefore, this paper aims to contribute to the existing literature on GPP by assessing the impact of specific determinants occurring on the country, government and contract level on adopting the green criteria to award the public contracts in the countries of the Visegrad Group (V4). The V4 comprising Poland, Czech Republic, Slovakia and Hungary, with a total population of 64 million, ranks 4th in the EU and, considering the economic power, represents the fifth largest economy in the EU and 12th globally (World Bank, 2019). Efficient implementation of the green aspects in contract award criteria to deliver better value for money by government authorities represents a big challenge for the V4 countries in rebuilding their economies damaged by pandemic to ensure digital, sustainable and inclusive growth.

This study uses data on contracts published in Tenders Electronic Daily from 2017 to 2019 awarded by contracting authorities in the V4 countries based on the most economically advantageous tender. Using content analysis based on keywords corresponding to environmental labelling, resource consumption, circular economy or waste, emission and toxicity reduction, we identify green award criteria in 4,561 out of 191,258 contracts. For further empirical analysis, the presence of green award criteria is treated as a binary variable, and the probability of its adoption is estimated using various specifications of the logit regression model. After recognising the model specification with the most explanatory power, we confirm a significant role

of regional and municipal authorities in attaining environmentally friendly goods, services and works. This paper adds to the current scope of research on GPP with its coverage focusing on contract lot level and implementation patterns of green award criteria.

The remainder of this paper is structured as follows. The following section provides the research background and an overview of related literature on selected determinants of GPP. Section 3 presents the data and methodology used in this research. The empirical analysis results are presented and discussed in Section 4, while the final section is devoted to the conclusion.

2. The Research Background

As already mentioned, environmental issues have been gaining professional and especially lay attention in the last decade. Therefore, it is not surprising that there is increasing literature in the field of GPP devoted to various areas related to the application of green aspects in procurement. Cheng et al. (2018), based on a literature review conducted on 67 research papers from 2000 - 2016, point out that GPP research literature can be classified into several categories depending on the objective of the research. It includes studies dealing with issues on the policies, regulations, and GPP implementation (e.g., Preuss, 2009; Grandia, 2016; Tsai, 2017), issues on the environmental specifications and norms (e.g., Igarashi et al., 2015; Katriina Parikka-Alhola, 2012; Nissinen et al., 2009; Rietbergen & Blok, 2013), issues of GPP effects and effectiveness (e.g., Lundberg et al., 2015; Lundberg & Marklund, 2013; Nikolaou & Loizou, 2015), and those concerned with practices and uptake issues of GPP (e.g., Brammer & Walker, 2011; Uttam & Roos, 2015; Igarashi et al., 2015; Günther & Scheibe, 2006). In general, the research on GPP focuses either on determinants of the GPP adoption or its effects and effectiveness. For obvious reasons, we will further discuss the literature on the determinants influencing GPP uptake occurring on various levels related to the procurement process.

The first group of GPP determinants comprises the factors related to the specifics of the respective country, such as its national legislation, size of the government or overall economic and environmental development. The second group of determinants occurring on the contracting authority level comprises the contracting authority's type, function, and characteristics. At both country and contracting authority levels, determinants stand outside the influence of individual public authorities carrying the procurement process and are also referred to as external determinants (Rosell, 2021). The last group of determinants concerns the factors related to the procurement process, hence contract level, which reflect the motivation, capacity or financial constraints of contracting authority. It comprises factors under the influence of contracting authority such as type of contract, establishing framework agreements, procuring contracts co-financed from EU funds, or even type of procurement procedure chosen by contracting authority to award the contract.

2.1 Country-Level Determinants or Time to Make GPP Mandatory?

Despite the recent European legislation on public procurement confirming the significant benefits of public procurement in meeting sustainable and inclusive

growth, the adoption of GPP across the EU Member states varies. Bouwer et al. (2006), analysing the GPP uptake in selected EU countries, point to the developed GPP perception reflecting in information resources, national GPP programmes, and the extensive implementation of GPP-friendly procurement techniques in overperforming countries. The study results conducted by Rosell (2021) suggest the relatively high heterogeneity in GPP proportion across the EU. The results of his study also confirm the previous findings (Bouwer et al., 2006; Renda et al., 2012) on Nordic countries being leaders in GPP adoption in the EU. Moreover, Džupka et al. (2020), analysing the cost-effectiveness of sustainable public procurement in the V4 countries, found that the proportion of environmental aspects within contract award criteria ranges between 12% to 65%.

One of the significant obstacles to GPP is contracting authorities' financial constraints (Schebesta, 2018; Sönnichsen & Clement, 2020). It is no surprise that purchasing green products involves higher prices (Džupka et al., 2020; Preuss, 2009). Contracting authorities still tend to avoid considering the whole-life costs in green product purchases. Therefore, economic development appears to be one of the determinants at the country level that influences the adoption of GPP, as wealthier countries are expected to spend more money on environmentally friendly products. Recently, the positive effect of the GDP per capita indicator on GPP adoption suggests that more prosperous countries tend to incline more to GPP (Rosell, 2021). On the other hand, income growth often comes at the cost of the environment, reflecting the exploitation of natural resources and more pollution through higher material and energy consumption (Wendling et al., 2020). However, economic development alone can barely influence the adoption of green aspects in public tenders without the interaction of other factors, such as good legislation or other governance-related factors.

As the GPP is still a voluntary policy instrument within the EU area, the extent and manner of its implementation in public procurement is left to the Member States, as long as it is, of course, not in conflict with EU legislation. Therefore, the further determinant with potential impact on GPP adoption is country-specific legislation. Each country can adopt legislative measures regulating activities with a negative environmental impact, such as introducing a waste management hierarchy into waste legislation or improving the energy efficiency of new construction buildings. It has proved that country's better public procurement regulation quality positively impact the performance of small and medium-sized enterprises (SMEs) in public tenders (Hoekman & Taş, 2020) and the cost-effectiveness of the procurement process (Tas, 2020). However, there is no proven link with whether better procurement regulation so far leads to greater adoption of GPP. The reason may be related to the difficulties in measuring the quality of a country's regulation because, as mentioned above, each country adopts its regulations to pursue its agenda. For example, Poland's principle of sustainable development has a constitutional basis, making the green considerations in tender documentation a common phenomenon (Kozik & Karasiska-Jakowiec, 2016).

Public procurement is primarily a public sector activity used across all government spending functions, from health to environmental protection sector, economic affairs not excluding (OECD, 2021a). The public sector size increases as a result of economic development, which fosters demands for transfers that are met by

increased government expenditures (Boix, 2001). The bigger, more developed government sector means the broader redistribution possibilities on GPP. When measuring the size of government by the government revenues as the percentage of GDP per capita, its positive effect on the GPP uptake could be a sign of effective governance in meeting sustainability goals.

2.2 Searching for the Key Actors among the Contracting Authorities in Fostering the GPP

Examining public procurement authorities' role and impact in either incenting the public procurement market or implementing EU horizontal policies is naturally another object of interest in public procurement literature. As a multifaceted phenomenon, it is becoming more linked to broader governance issues, including good governance, among others (Ladi & Tsarouhas, 2017). In terms of the country's traditional spread of power, public authorities operating at sub-national levels of government as a result of decentralisation are becoming increasingly important players in sustainability. Generally, decentralisation refers to transferring powers and responsibilities from the central government to elected authorities at sub-national levels such as regional governments or municipalities (OECD, 2019). The academic rationale behind the decentralisation is that local governments understand the local needs better (e.g., Foray, 2014; Klugman, 2013). Strengers (2004) argues that local government is widely recognised as an environmental leader while advocating the policies of other levels of government. The leading role of EU regional and local government in GPP has been confirmed by Renda et al. (2012). They found that 67% of regional or local government authorities include environmental aspects in their procurement policy, against 60% of respondents operating on the central government level. Testa et al. (2012), analysing the factors influencing the inclusion of green criteria by Italian public authorities, found that the dimension of public authority and the level of awareness positively affect GPP adoption. The study by Rosell (2021), who analysed contracts awarded between 2006-2017 in the EU, suggests a higher probability of GPP adoption by lower-tier and decentralised public authorities than those operating on a national or federal level. Moreover, the EU institutions that are beyond the perception of the national or federal dimension show the lowest GPP adoption rates compared to all other government levels (Badell & Rosell, 2021). Although recent results suggest a growing inclusion of green aspects in public procurement by bodies imaginarily moving away from central government, there are known differences between member states' structure and functional organisation of government between the EU Member States (Thijs et al., 2017). For example, a systematic and comprehensive analysis focusing on implementation sustainability aspects into procurement processes, performed by Brammer and Walker (2011), shows how policy in sustainable procurement and factors vary across regions.

Among other characteristics of public authorities, in addition to their position within the functional and organisational structure of the government in a given country, also include the sector of its main activity. The sector of activity is also referred to as the function of the government, which the individual public authority fulfils. The inclusion of green aspects into procurement procedures typically varies among the respective sectors of government functions and could not be relevant in

every sector of contracting authority activity. For example, a contracting authority with the main function comprising the recreation, culture and religion sector will probably have less need and awareness of green aspects when procuring goods or services needed fulfilling their tasks such as broadcasting, religious or other community services. Conversely, a public authority fulfilling activities with higher environmental impact, the inclusion of green aspects are expected to be at a higher GPP rate.

2.3 Contract Level Variables

Factors related to either the procurement process or the contract are a relatively often subject of research conducted in the public procurement field. Research interest mainly focuses on their impact on procurement outcomes in competition (e.g., Hoekman & Taş, 2020; Kubak et al., 2021; Stake, 2017) or cost-effectiveness (e.g., Nemeč et al., 2020; Džupka et al., 2020; Tas, 2020). However, examining the relationship between GPP and a complex set of factors, such as the type of procurement procedure, framework agreements, central purchasing body, joint procurement or co-financing contract by EU funds, the research literature narrows. With a few exceptions mentioned above, attention is mainly paid to environmental considerations in the evaluation criteria for the award of a contract, product groups or individual type of contract (Nissinen et al., 2009; Parikka-Alhola et al., 2006; Bouwer et al., 2006; Renda et al., 2012; European Commission, 2015).

Recent findings by Rosell (2021) and Yu et al. (2020) confirm differences in the adoption of green award criteria depending on whether the subject of the contract is goods, services or works. Procuring goods provides the most effective opportunity for procurers to adopt the green criteria, given the more straightforward measurement and monitoring of these criteria (Rosell, 2021).

The inclusion of green aspects in public contracts is associated with higher final prices. The above-cited literature reveals its positive effect on GPP adoption. Concerning the methodology of the phenomenon under investigation, it should be recalled that the final price results from the inclusion of green aspects in the procurement rather than the determinant of GPP. Therefore, the contract's estimated value should be considered a determinant that potentially influences the adoption of GPP. Notwithstanding the above, the estimated value of a contract is often debated due to the absence of a standardised procedure for its determination. Contracting authorities often tend to set the estimated value of a contract that does not correspond to the market or real expected price (Nemeč et al., 2020).

Awarding the contracts using an Open procedure allows any economic operator to submit a bid, and it is perceived as the most transparent procurement procedure. The vast majority of contracts awarded by contracting authorities in the EU use the open procedure (Kutlina-Dimitrova & Lakatos, 2016). The remaining procedures involve Restricted procedure, Competitive dialogue, Contract award with or without prior call for competition; contracts in such procedures are usually awarded based on tender between pre-qualified bidders or the economic operators are directly approached by contracting authorities. However, despite its positive effects on cost-effectiveness (Tas, 2020), competition (Kubak et al., 2021) and SME performance (Hoekman & Taş, 2020; Nemeč et al., 2021), the recent findings shows

its impact on GPP adoption weakens when compared to Competitive dialogue or Restricted procedure (Yu et al., 2020).

3. Data Description and Research Methodology

3.1 Data Description

For this research, we use data on contract award notices (CAN) published in Tenders Electronic Daily (TED) by the Polish, Czech, Hungarian, and Slovak contracting authorities from 2017 to 2019. TED serves as an online version of the Supplement to the Official Journal of the EU dedicated to public procurement (European Union, 2021). The analysed TED datasets¹ include the data from contract award notice standardised forms used by contracting authorities to report relevant information on awarded contracts above the procurement threshold set by the EU procurement directives. In other words, data on contracts contain information such as who bought what from whom and which procedure and award criteria were used (DG GROW, 2015).

The original dataset comprised 616,708 CANs, of which we excluded data on contracts that were not awarded to any economic operators because they were later cancelled or these which do not contain data needed for this research, such as information about contracting authorities, the estimated value of the contract, and contract award criteria. We also excluded the contracts awarded by the EU institutions and agencies since EU procurement directives generally do not cover their procurement. As for the research period, because of the transposition period to revise the Members state procurement law, set by the EU procurement directives adopted in 2014, this research focuses on 2017 - 2019. Although the EU procurement law obliges the contracting authorities to report awarded contracts no later than 30 days, some contracting authorities often see one year or even longer delays in fulfilling this obligation. For this reason, we excluded the notices on contracts awarded before 2017 but reported only in the following years, which led to a drop of 169,269 CANs. Finally, to avoid data distortion on the value of contracts, we have excluded contract lots with an estimated value below one hundred and more than 100 million euros (77,953 CANs).

Concerning TED as a primary data source, some limitations related to the nature of data should be raised. Although TED data on contracts are currently the most comprehensive source of information on a large number of public contracts across the EU, on the other hand, they are often discussed for their incompleteness and inaccuracy (Testa et al., 2016). Therefore, a rigorous approach to evaluating TED data is needed, supported by expertise from procurement practitioners, to understand the structure of forms used by contracting authorities as contract notices. Nevertheless, missing data is still a problem; 27% of observations from the original dataset suffered from missing data.

The steps mentioned above led to our primary database containing 369,486 contracts awarded based either on the lowest price (48.2367%) or the most economically advantageous tender (MEAT) (51.7633%). To identify environmental

¹ The TED subsets on contract award notices are available at European data portal: <https://data.europa.eu/data/datasets/ted-csv?locale=en>

aspects in contracts, we consider only those awarded using MEAT evaluation. The reasons are as follows: First, it is the nature of MEAT itself; awarding contracts based on the MEAT evaluation is recognised as a key tool for obtaining value for money in public procurement (e.g., OECD, 2021b; 2011b) because it allows the contracting authorities to consider and also reward the other aspects of submitted tenders than the lowest price. Setting the minimum quality criteria in the tender documentation and then assigning the weights to them ensures compliance with the minimum quality and allows the tenderer to be rewarded for any added quality at the same time. Inclusion of environmental aspects into quality award criteria stimulates the economic operators to further innovations in offering products, services or works, which could be in the award phase assessed using the best price-quality ratio or life cycle costs by the contracting authority. MEAT criteria thus allow contracting authorities to reward the added quality of the products or services that may outweigh the higher offered price. Green award criteria often complement other more prominent non-price criteria such as guarantee and project execution time (Plebankiewicz & Kozik, 2017). The weight given to environmental aspects within award criteria ranges between 5 and 20% (Parikka-Alhola et al., 2006). Nemeč et al. (2021), in their research on sustainable public procurement in the V4 countries, argue that the average relative weight of quality criteria enriched by environmental aspects is higher compared to traditional quality criteria.

The second reason for considering only contracts using MEAT evaluation is pretty straightforward; the TED database contains information on specific award criteria only when the contracting authority chooses to award a contract using MEAT criteria. Such data limitation relates to another shortcoming of this study because it leaves aside the substantial proportion of contracts awarded using the lowest price criterion. Moreover, the environmental aspects that contracting authorities could potentially include in the technical specification, selection criteria or exclusion criteria, and contract performance clauses (Appolloni et al., 2019; EU, 2016) regardless of the award criteria cannot be distinguished because the TED database does not contain this data.

The primary dataset used for this research consists of 191,258 CANs, of which every single CAN corresponds to an individual contract lot awarded by the contracting authority to the individual economic operator in procurement. The contracting authorities often divide contracts into smaller, financially and technically less demanding lots to improve access of small and medium-sized enterprises to public procurement. Even though some prior research using the TED data conducted empirical analysis only on single-lot contracts (e.g. Rosell, 2021), we employ a different approach while also analysing the contracts divided into several lots. The data on the contract lot level allows observing individual characteristics of each lot related to its financial value or award criteria, which could stay otherwise unobserved.

3.2 Dependent Variable

To determine the presence of green criteria in awarding an individual contract, we adopt a similar approach as used in previous studies (e.g., Yu et al., 2020; EC, 2015; Rosell, 2021; Nemeč et al., 2021) based on using keywords corresponding to

the concept of GPP in the respective languages. In selecting appropriate keywords to identify potential environmental aspects within the procurement criteria, we compiled a preliminary list of keywords based on the framework used by Yu et al. (2020) and EC (2015) in their research. However, using the extensive framework may lead to overestimating the presence of green criteria in contracts. For example, words such as guarantee, warranty, or maintenance were identified in more than 26,000 contract award criteria. On the other hand, using only a limited number of words, e.g. environmental, sustainable or green, may also bias the results by leaving the potential green contracts unobserved. In order to address the issues mentioned, we compiled a list of more than 80 keywords, including their language variations, which were classified into one of five sub-categories corresponding to their meaning (Appendix Table 6).

Our dependent variable is the binary variable that takes a value of one when one or more environmental aspects within award criteria are present, while it takes zero otherwise. Recall that the dependant variable only captures environmental aspects as one of the contract award criteria but not their relative weight as the potential of being a decisive factor in awarding the contract to the tenderer offering "most green tender".

In Table 1., we present the incidence of keywords distinguishing the green contracts by respective sub-categories. Zooming into the level of the sub-categories through which green award criteria were implemented, it becomes evident that general environmental terms and those focused on reducing waste and emission were the most frequent in contracts examined. Besides that, we can observe the remarkable low score of terms corresponding to environmental labelling, so it appears they are implemented through technical specification or selection criteria rather than award criteria.

Table 1 Green Award Criteria Implementation

<i>Sub-category</i>	<i>Total count</i>
General words (GW)	1786
Environmental label (EL)	133
Resource consumption (RC)	828
Waste, emission and toxicity (WET)	1904
Circular economy (CE)	816

The table above (Table 1) indicates that some contracts contain award criteria corresponding to more than one sub-category. More specifically, each contract with green criteria contains, on average, 1.20 different sub-categories. There was only one contract combining criteria belonging to four of the total five sub-categories. Furthermore, Table 2 provides a more detailed insight into the implementation pattern of green aspects by contracting authorities.

Using exclusively general words such as environmental, ecological, sustainable, or green shows the most general practice of contracting authorities implementing the green criteria, which usually does not need any other complementary categories. On the other hand, the second most exclusively used words corresponding to the waste, emission and toxicity sub-category (1,178

contracts) seem close to the resource consumption and circular economy sub-categories and complement each other. Indeed, including more categories into award criteria does not necessarily mean the contract is greener. Rather, it shows the more precise way of setting the environmental considerations by the contracting authority in award criteria instead of letting their description on tender documentation. For example, using terms such as "environmental friendliness" or "sustainability criteria" in the tender notice form may mean that the environmental award criteria can include emission reduction requirements or more complex requirements.

Table 2 Incidence of Single Sub-Category Criteria and Their Combinations

<i>Number of sub-categories</i>	<i>Sub-category</i>	<i>Count</i>
<i>Single sub-category</i>	GW	1780
	WET	1178
	CE	560
	RC	477
	EL	37
<i>Two sub-categories</i>	WET*RC	277
	GW*WET	225
	WET*CE	155
	EL*CE	64
	GW*RC	24
	GW*EL	11
	WET*EL	6
	RC*CE	5
	GW*CE	4
RC*EL	2	
<i>Three sub-categories</i>	GW*WET*RC	28
	GW*WET*CE	12
	WET*RC*CE	12
	GW*WET*EL	10
	RC*EL*CE	2
GW*EL*CE	1	
<i>Four sub-categories</i>	GW*WET*RC*CE	1

3.3 Explanatory Variables

We employ several explanatory variables occurring on various procurement levels to assess their effect on adopting green criteria for awarding public contracts. Most variables related to data on contracting authorities, procurement procedures or contracts come from the TED database, while other variables related to country-level were obtained from other data sources. Although previous research used explanatory variables related to the bidding phase, e.g., number of tenders or bidder characteristics (Yu et al., 2020) or to awarding phase, e.g. final contract price (Rosell, 2021), issues concerning focal relationships between dependent and explanatory variables need to be addressed first. Green award criteria as a dependent variable occur at the latest in the call for tender; therefore, we only consider variables that antecede the green award criteria in constructing the appropriate set of explanatory variables. Table 3 presents the summary and description of explanatory variables.

Table 3 Summary and Description of Explanatory Variables

Variable	Description
<i>Government size</i>	As for a variable measuring the public sector size, we use total government revenues as a percentage of GDP (Boix, 2001). Data on country government revenues for the respective year of contract award were obtained from Eurostat archives. We hypothesise that higher government revenue positively affects the adoption of green award criteria. The rationale behind this is that green contracts tend to be less cost-efficient than more traditional goods, services and works, so the more funds the governments collect, the more resources they can spend on environmentally enriched contracts.
<i>The Environmental Performance Index ranking</i>	Denotes each Country's Environmental Performance Index (EPI) rank in the respective year of contract award. The EPI shows how countries achieve the fulfilment of the environmental policy targets. The EPI ranks 180 countries' performance on environmental issues, environmental health and ecosystem vitality using several performance indicators in categories such as Air Quality, Water and Sanitation, Heavy Metals, Forests, Fisheries, Climate and Energy, Air Pollution, Water Resources, and Agriculture (Wendling et al., 2020, 2018; Hsu et al., 2014). Methodology changes in EPI score construction in 2018 compared to the 2016 EPI version mean that EPI scores from the previous period are not comparable (Wendling et al., 2018). Using EPI ranking rather than a score of the respective country helps overcome mentioned issue and allows us to perceive the environmental performance in the context of other countries' performance. We use the Country EPI 2016 ranking for contracts awarded in 2017 and 2018 and the EPI 2018 ranking for contracts in 2019. As the EPI ranking is compiled from top to bottom, its higher values mean worse performance in environmental domains.
<i>Contract value</i>	Determines the estimated value of the contract lot awarded in euros without VAT, included in estimation models as a natural logarithm. Given that green products are naturally more expensive, we expect green criteria to be more likely in contracts with increasing estimated value.
<i>Level of Government</i>	The level of government is a categorical variable that classifies the scope of the contracting authority as follows: national authority such as parliament and ministries; national agencies governed by national authorities representing the lower tiers of government; a regional or local authority including self-governing regions or local administrative units and agencies governed by them; sectoral contracting authorities that operate in water, energy, transport and telecommunications sectors; body governed by public law that includes NGO's founded or controlled by other contracting authorities and various organisations providing the services of general interest; and other entities that are not generally required to comply with public procurement rules, but which, if they are spending public funds, are considered contracting authorities. Concerning the classification above, we are particularly interested in how the regional or local government level affects the adoption of green award criteria compared to contracting authorities operating on the national or federal level. Considering the previous findings on more frequent GPP adoption or perceiving the barriers to its adoption, we hypothesise that authorities on the regional and local levels are more flexible and tend to adopt the green award criteria more often than national authorities.
<i>Function of Government</i>	The categorical variable that determines the main activity of individual contracting authority is based on OECD standards classifying the purposes of government activities. As for the contracting authorities operating under the EU Sectoral Procurement Directive, the classification corresponds to their activity areas according to the Art. 8 to 14 (EU, 2020; Eurostat, 2019): General public services, Defence, Public order and safety, Economic affairs, Environmental protection, Housing and community amenities, Health, Recreation, culture and religion, Education, Social protection.
<i>Joint procurement</i>	The binary variable denotes whether two or more contracting authorities carry out the procurement procedure. Joint action by several contracting authorities is perceived as a possible tool to support GPP, allowing smaller municipalities to access green products that would not otherwise be able to access them (EU, 2016). Joint procurement aims to meet several contracting authorities' needs and achieve economies of scale, given the cumulation of purchasing power. Because the large volume contracts are a natural part of joint procurement action, similar to the case of the increasing contract value, we expect a positive effect on green award criteria.
<i>Framework agreement</i>	The binary variable indicates whether procurement resulted in establishing a framework agreement (FA). The purpose of FA is to establish terms governing contracts to be awarded during its duration. Such terms can include a price and, where appropriate, the

	quantity envisaged. Generally, FA's are perceived as an important tool in the GPP context as they embrace procurement of a vast amount of goods with environmental impact (Bauer et al., 2016).
<i>Central purchasing body</i>	The binary variable expresses the award of a contract by a contracting authority as a central purchasing body (CPB). The role of CPB is to offer centralised procurement activity that lies in acquiring goods and services for other contracting authorities, awarding such contracts, or concluding the framework agreements intended for other contracting authorities (EU, 2014). Establishing CPB aims to achieve economies of scale because large volume contracts should generate better prices (OECD, 2011).
<i>Type of contract</i>	Type of contract is the categorical variable that expresses whether works, supplies or services are procured.
<i>EU funds</i>	The binary variable denotes whether the contract is related to a project or a programme financed by European Union funds. In recent years, the increasing role of EU funds towards the green economy is well known. Given the objectives and priorities of the Europe 2020 strategy, many national authorities across the EU have set mandatory environmental requirements as conditions for approving project proposals co-financed by EU funds. We, therefore, expect a positive impact of the EU-funded contracts on the adoption of green aspects within the contract award criteria.
<i>Government Procurement Agreement</i>	The binary variable indicates whether the contract is covered by the Government Procurement Agreement (GPA). The GPA is a plurilateral agreement within the framework of WTO and aims to open government markets among its signature parties mutually. GPA provides the legislative framework that ensures open, fair and transparent conditions of a competition (WTO, 2015). However, the GPA rules apply only to procurement activities, which entities covered by GPA carry out for acquiring certain goods, services and works of a value exceeding threshold values set by GPA. ²
<i>Open procedure</i>	Binary variable indicating whether contracting authority used the Open procurement procedure or one of the remaining procurement procedures to award a contract.

Table 4 Characteristics of Examined Contracts

	<i>Total</i>	<i>Green criteria</i>	<i>No green criteria</i>
<i>Number of contracts awards</i>	191258	4561	186697
<i>Contract value (in billion euros)</i>	68.58	7.29	61.29
<i>Number of contracts awarded per government level</i>			
<i>National government authority</i>	9999	471	9528
<i>National government agency</i>	2538	150	2388
<i>Regional or local authority</i>	13947	1242	12705
<i>Regional or local agency</i>	2526	219	2307
<i>Sectoral contracting authority</i>	3430	107	3323
<i>Body governed by public law</i>	76277	829	75448
<i>Other</i>	82541	1543	80998
<i>Type of contract</i>			
<i>Supplies</i>	142067	1942	140125
<i>Services</i>	43134	2361	40773
<i>Works</i>	6057	258	5799
<i>Awarded using Joint procurement</i>	2301	226	2075
<i>Awarded by Central purchasing body</i>	1429	186	1243
<i>Framework agreement established</i>	8816	358	8458
<i>EU funds</i>	21559	739	20820
<i>Contracts awarded using Open procedure</i>	186039	4436	181603

² The Appendix I to the GPA contains the coverage schedules and specifies the concerned contracting authorities that have to carry out the procurement procedures under the rules covered by GPA. For more detail on four dimensions of GPA coverage, see: https://www.wto.org/english/tratop_e/gproc_e/gp_app_agree_e.htm

Data in Table 4 confirm the higher financial intensity of contracts with green award criteria than using a more traditional MEAT evaluation. Even though the relatively low proportion of contracts with green criteria (2%), the average value of such contracts is five times higher than other contracts.

The data also suggest the more frequent use of green criteria in awarding the contracts by the regional and local authorities than the central government. The green criteria appear in 8% of all contracts awarded by regional or local contracting authorities, representing almost one-quarter of these authorities' total funds spent on procurement. For comparison, the share of green criteria in contracts awarded by national contracting authorities is approximately half (4%) and represents 7% of their total financial value.

3.4 Estimation Approach

To answer the research question, to what extent do the selected determinants influence the adoption of green criteria within MEAT evaluation, we employ logit regression. Due to the nature of the dependent variable, which is essentially binary-dichotomous, binary logistic regression overcomes the restrictive assumptions of linear regression (Cox, 1958). The equation of the model is as follows:

$$\ln\left(\frac{\Pr(GPP = yes)}{1 - \Pr(GPP = yes)}\right) = \beta_0 + \sum_{i=1}^n \beta_i \times x_i \quad (1)$$

where $\Pr(GPP = yes)$ expresses the probability that green award criteria occur in MEAT contract evaluation, and $1 - \Pr(GPP = yes)$ denotes the probability of otherwise, β_0 is a constant in the model, β_i denotes the estimated regression coefficients, and x_i is the set of explanatory variables previously described in Table 3. Appendix Table 7 presents the results of descriptive statistics for variables used in this model.

We run three regression model specifications, differing from each other only by incorporating country fixed effects and government function fixed effects. The first model contains all the explanatory variables described in the previous section, with no fixed effects included. The second regression model adds the country fixed effects, and the third model combines all the explanatory variables with country and government function fixed effects.

4. Results and Discussion

4.1 Results

Table 5 presents the estimation results captured on over 191,000 observations using all three model specifications. Adding the fixed effects (Model II and III) improves the model explanatory power without significant changes in estimation coefficients on all three variable levels.

Table 5 Estimation Results of Logit Model of Green Award Criteria

<i>Variable</i>	<i>Model I</i>	<i>Model II</i>	<i>Model III</i>
Country Variables			
<i>The EPI rank</i>	- 0.0002 (0.0025)	0.0127*** (0.0029)	0.0108*** (0.0029)
<i>Government size</i>	0.2291*** (0.0104)	0.3224*** (0.0498)	0.3316*** (0.0491)
Contracting authority variables			
Level of Government (National government body as default)			
<i>National agency</i>	0.4743*** (0.1029)	0.3789*** (0.1037)	0.3937*** (0.1032)
<i>Regional or local authority</i>	0.8273*** (0.0605)	0.8719*** (0.0616)	0.7382*** (0.0652)
<i>Regional or local agency</i>	0.8475*** (0.0906)	0.8473*** (0.0914)	0.9756*** (0.0995)
<i>Sectoral contracting authority</i>	- 0.7157*** (0.1131)	- 0.6970*** (0.1144)	- 0.8998** (0.3686)
<i>Body governed by public law</i>	- 0.6061*** (0.0681)	- 0.5368*** (0.0696)	- 0.0649 (0.0729)
<i>Other contracting authority</i>	- 0.2844*** (0.0613)	- 0.2070*** (0.0628)	- 0.1050 (0.0659)
<i>GPA</i>	0.0130 (0.0377)	- 0.0506 (0.0379)	- 0.0786** (0.0389)
<i>Central purchasing body</i>	1.2628*** (0.1133)	1.1948*** (0.0914)	1.0369*** (0.1027)
Contract variables			
<i>Estimated contract value (log)</i>	0.3311*** (0.0085)	0.3287*** (0.0084)	0.2982*** (0.0083)
<i>Joint procurement</i>	0.5665*** (0.0805)	0.5938*** (0.0804)	0.5416*** (0.0801)
<i>Framework Agreement</i>	- 0.3055*** (0.0707)	- 0.4227*** (0.0702)	- 0.4119*** (0.0695)
<i>Open procedure</i>	0.6005*** (0.0993)	0.7222*** (0.1015)	0.7398*** (0.1011)
<i>EU funds</i>	- 0.1533*** (0.0468)	- 0.1906*** (0.0468)	- 0.3534*** (0.0469)
Type of contract (Works as default)			
<i>Supplies</i>	0.7684*** (0.0734)	0.7402*** (0.0738)	1.0364*** (0.0720)
<i>Services</i>	1.3282*** (0.0682)	1.3101*** (0.0688)	1.1308*** (0.0681)
<i>Constant</i>	- 18.311*** (0.4909)	- 22.092*** (1.9842)	- 21.820*** (1.9607)
<i>Country FE</i>	No	Yes	Yes
<i>Function of government FE</i>	No	No	Yes
<i>Log pseudolikelihood</i>	- 18163.64	- 18103.43	- 17523.25
<i>Pseudo R2</i>	0.1570	0.1598	0.1867
<i>AIC</i>	36363.28	36248.82	35116.51
<i>Observations</i>	191,258	191,258	191,189 ³

Notes: *** p < 0.01; ** p < 0.05; * p < 0.1; robust std. errors in parentheses

³ A total of 69 observations on government activity sectors related to the port and airport-related sectors were omitted due to the perfect prediction of the dependent variable outcome.

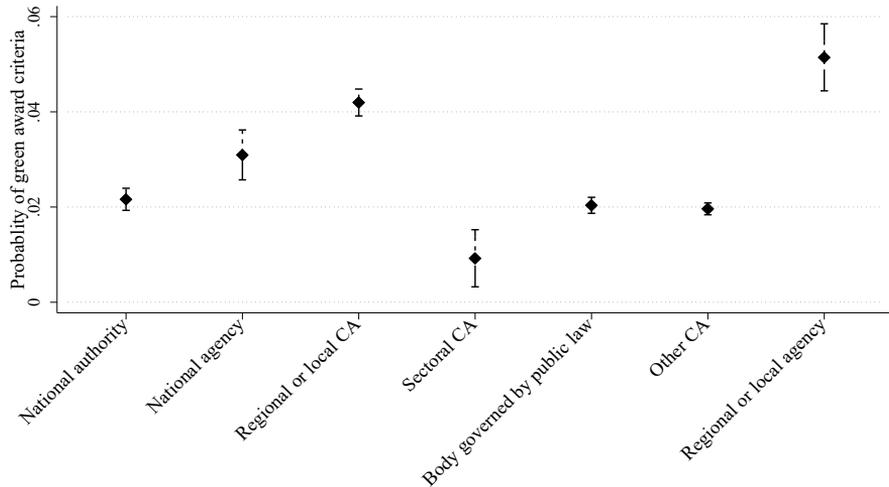
Considering the pseudo-R2 and Akaike information criterion, the model with the best fit is the third model specification (Model III), including fixed effects of both Country and Function of Government. For this reason, we limit further interpretation of direct effects revealed by the third model.

As for country-level variables, the positive effect of EPI ranking indicates that a lower ranking in the overall performance ladder slightly reduces the probability of green award criteria presence. Although such a result might seem unexpected, it does not mean that a better country's environmental performance necessarily leads to less green public procurement and vice-versa. As noted above, the estimation captures only the probability of green criteria presence in contracts awarded using MEAT evaluation, while there are other more accessible ways to implement green aspects in procurement contracts. Environmental requirements arising from country-specific legislation, which are reflected in the technical specification, selection criteria or contract clauses, can easily cause such contracts to be considered green, regardless of the tender evaluation criteria used. In other words, the dropped sample of 178,228 contracts awarded based solely on the lowest price, by which the presence of green considerations in mentioned forms could not be identified, may change the results. Nevertheless, focusing on MEAT evaluation can provide helpful insight into how this tool for maximising value for money is used to implement green criteria in the country's environmental performance context. Results of recent studies (e.g., Bauhr et al., 2020; Fazekas, 2017; Plaček et al., 2020) suggest that, besides the traditional factors occurring directly in the procurement process, empirical research on public procurement should also focus on factors related to the institutional and economic environment in which contracts are awarded. The bigger government measured revenues to its GDP usually links to broader redistribution options. Indeed, the size of the government matters; its positive effect suggests spending taxpayers' money in an environmentally efficient way while procuring services, supplies and works. Although this finding is in line with previous results, one should remember that public procurement is a complex process taking place in an everyday environment, where the effects of a relationship between a combination of various factors may not always be linear. Using data on more countries could help understand non-linearities in relationships between factors such as government size, environmental performance, estimated contract value, and their potential impact on GPP adoption in such varied environments.

Estimates on decentralisation suggest a shift of power decision making both on a vertical and horizontal level could play a significant role in adopting the green considerations in public procurement. The probability of green criteria presence in contracts awarded by decentralised contracting authorities such as municipalities or regional governments is higher than at the national-centralised level. It confirms the widely recognised important role of local and regional governments in implementing environmentally-oriented measures (e.g., Bush, 2020; Wilson & Vihlová, 2000). However, despite the positive attitude of local contracting authorities towards GPP, they often face a trade-off between implementing green criteria and administrative compliance in the procurement process (Plaček et al., 2021). Concerning horizontal

decentralisation, hence power diffusion from the centre among other bodies on the same governmental tier, the effect on green criteria is also positive. While the agencies on the national level tend to adopt green award criteria more often than the principal organisations at the centre, the deconcentration at the regional or local level, the positive effect increases even more. Figure 1 shows the predictive margins of green award criteria by contracting authority at a 95% confidence interval.

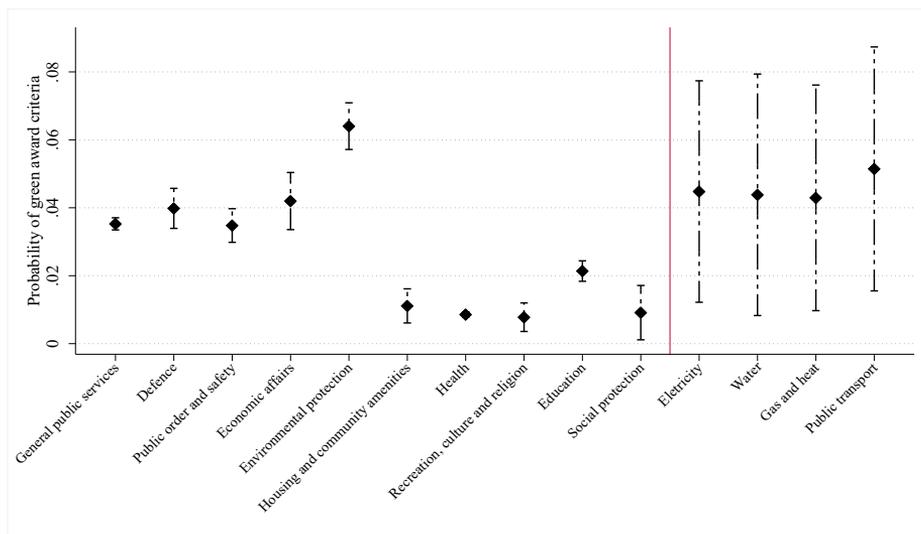
Figure 1 Estimated Probability of Green Award Criteria by Contracting Authority at 95% CI



The lower margins of green award criteria (Figure 1) for contracting authorities both governed by public law and those under the "other" category might be associated with a diversity of subjects comprising those categories. Greater procedural autonomy and flexibility of these authorities, hence the absence of top-down directives, or at least to a lesser extent, may also hinder the inclusion of green criteria in MEAT evaluation.

Figure 2 shows the estimated probability of using the green award criteria according to the contracting authority function. We can distinguish two groups; the first group comprises the classic functions according to the COFOG classification (Eurostat, 2019), left side of Figure 2. The second group includes contracting authorities with main activity regulated mainly under the EU Sector directive, right side of Figure 2. Sectors related to port, railway and airport services were omitted due to their statistical insignificance.

Figure 2 Estimated Probability of Green Award Criteria by Contracting Authority Sector at 95% CI



Contracting authorities providing services with significant potential environmental impact in forestry, agriculture, fuel and energy, mining, manufacturing and construction and transport (Economic affairs sector) or waste management, pollution abatement and biodiversity protection (Environmental protection sector) show the highest probability of green award criteria in their contracts.

Among the contract level variables, estimated contract value, as expected, has a positive effect on green award criteria adoption. Indeed, pursuing environmental goals through public procurement has a cost effect. The inclusion of green criteria reflects more complex tender documents and increases the need for external consultants to prepare the procurement cycle (Kunzlik, 2013). Forging the more traditional quality criteria into the more sustainable award criteria makes the bidding and evaluation phase even more complex and demanding, increasing the direct and indirect costs for both contracting authority and supplier. In this context, it is necessary to reiterate some reservations concerning the absence of a binding procedure in determining the estimated contract value. Therefore, the estimated contract value may vary depending on the different methods chosen by the relevant contracting authorities, with the type of contract or establishment of a framework agreement in this process also being a factor.

Moreover, contracting authorities operate at different government levels, reflecting their budgetary capabilities and further limitations in potentially implementing the green criteria in their contracts. To examine the effect of the position of contracting authorities with increasing estimated contract value on green award criteria, we add to Model III an interaction term between the estimated contract value and the relevant type of contracting authority. In Appendix Table 8,

we present the empirical specification's estimation results, including interaction terms between mentioned variables. As expected, the effect of the contract value is positive and, in all cases, except for national agencies, statistically significant. Figure 3 plots the contrast in average marginal effects of regional and local authorities against those operating on the national level at 95% CI.

Figure 3 Contrast of Average Marginal Effects Between Centralised and Decentralised Authority

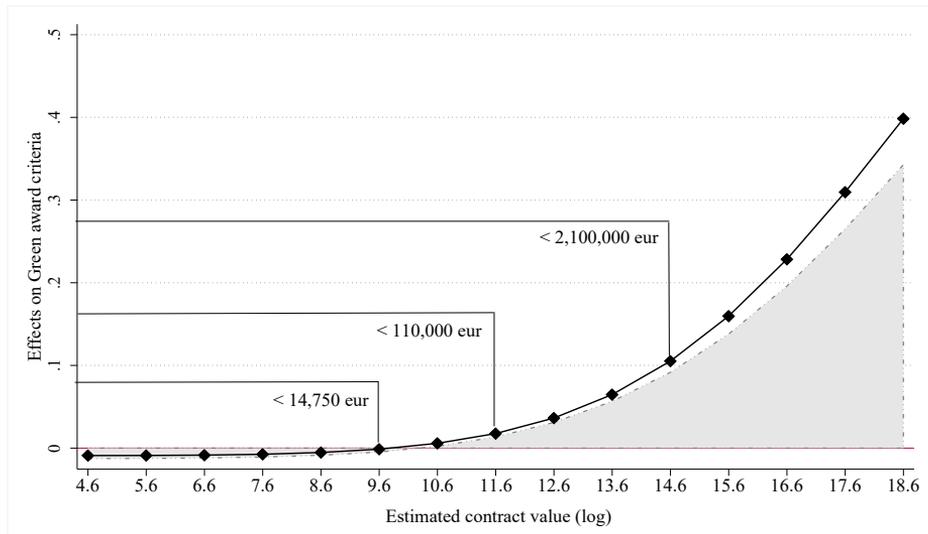


Figure 3 indicates that the positive effect of regional and local authorities on green award criteria is weaker than national authorities only when the contract value is relatively low. On the other hand, with increased contract value, this effect is amplified, indicating the more efficient use of large financial volume contracts in obtaining environmental value for money through green award criteria than national authorities.

The nature of supplies and services contracts makes them more appropriate for including environmental aspects directly in MEAT evaluation than works contracts. The construction sector is not homogeneous, involving various more or less complex and financially demanding activities, from the construction of new buildings to the renovation of old ones, not to mention large infrastructure projects. Evaluating and further monitoring the green award criteria during the project implementation period can stress the administrative capacities, especially in the case of smaller contracting authorities. Therefore, the environmental requirements may often result directly from the technical specification or the contract performance clauses, reflecting the mandatory standards arising from legislation. Indeed, this also applies to supply and service contracts. Still, the inclusion of green aspects to award criteria, combined with environmental requirements set out in the tender documents,

allows to measure and reward the added environmental value of the tenders, making contracts more environmentally robust.

Concerning the centralised purchasing through framework agreements, joint procurement or carrying the procurement central purchasing body, the estimation results highlight the complexity of the whole procurement process. Despite the well-documented advantages of cooperative purchasing in terms of price savings (e.g. Burns, 2014; Karjalainen, 2011), the successful implementation of such centralised purchasing requires coordinating the interests of all participants. On the other hand, coordination cannot work unless the advantages of cost effects of centralisation are visible to the involved participants (Faes et al., 2000). In this context, Schotanus et al. (2010) consider that inadequate communication, lack of commitment or even internal support from participating authorities are important impediments to successful joint procurement. The estimation results suggest that attaining lower costs by increasing market power through product bundling using framework agreements is associated with a lower probability of green criteria presence than regular contracts. Although the perceived role of framework agreements in achieving economies of scale, Džupka et al. (2020) found that framework agreements using MEAT evaluation in the V4 countries are associated with lower price savings rather than classic contracts. They discuss possible reasons for higher costs and point to the nature of framework agreements themselves. Therefore, the higher internal and external costs might be a reason for the trade-off between green and more conventional award criteria. At the same time, procurers can still include the green aspects in technical specifications or contract clauses depending on the more or less standardised product category. Thus, using MEAT evaluation to promote sustainability goals is not the question of whether but rather when to centralise purchasing activities. However, further research focusing on product groups with potentially significant environmental impact could help answer this question.

Although the EU funds represent the key instrument in supporting the development of the least developed Member States, with the V4 countries being among the top recipients (EC, 2021), the probability of green criteria in MEAT evaluation is lower than standard contracts. The procurement of EU funded projects links to enhanced bureaucratic controls and transparency requirements (Fazekas & King, 2019), reflected in a complex and multi-layered control system (OECD, 2021c). Previous findings by Plaček (2017) suggest that besides the negative impact on price, procurement of EU-funded contracts leads to a higher probability of procurement law violation. From the cost perspective, EU-funded contracts tend to be less efficient than regular contracts regarding savings creation (Plaček, 2017; Džupka et al., 2020). Financial constraints and concerns about legal disputes may be why contracting authorities avoid using environmental award criteria and, in fact, a MEAT evaluation itself for EU-funded contracts.

Finally, carrying out procurement using the first place auctions (Open procedure) shows a significantly higher probability of green award criteria than other procurement procedures. As the prior public call for tenders allows any economic

operator to submit a tender, including green award criteria within MEAT evaluation is logical, thus enabling tenderers to compete for the best price-quality ratio. Given the open procedure's other effects on strengthening the competition, its positive impact on environmental award criteria is indeed a positive sign. However, due to the minor number of cases related to other procedures, we could observe only the effects of open and other procedures. It would be beneficial to observe the effects of other procedures, such as Innovative partnership or Competitive dialogue, designated for introducing the new innovative elements that can boost the sustainability of procured supplies, services and works.

4.2 Robustness Check

Because the dependent variable indicating the presence of green criteria in MEAT evaluation consists of various keywords belonging to the sub-category of GPP, we provide the robustness check to test for potential changes in estimation results affected by the respective sub-category green award criteria. We extend the dependent variable by gradually adding the individual sub-categories of GPP, thus increasing the threshold of keywords initially used to identify the green award criteria. The order in which we added the sub-categories corresponds to an assumption on the potential bias in individual contracts' perceived greenness. There could be little doubt on green award criteria presence in contracts that include words "environmental", "ecological", or "ISO 14001" compared with contracts awarded by criteria containing words such as "noise emissions" or "fuel consumption". Therefore, we start the robustness check with a dependent variable comprising keywords corresponding to the general words and extend it further by environmental labelling and other sub-categories. Appendix Table 9 presents the estimation results with model specifications corresponding to Model III. We do not observe significant changes in the estimation coefficients by adding sub-categories except the central purchasing body and purchase contracts (supplies). However, such changes are logical because the base category comprises general environmental terms or their combination with environmental labelling (Model A and B), which are more suitable for works or service contracts. Indeed, by adding the keywords corresponding to waste, emission and toxicity reduction (Model C), such as CO₂ emission reduction, carbon footprint or vehicle emission class, the estimation coefficients turn close to the final model (Model D).

5. Conclusions

Through content and econometric analysis, this paper focuses on understanding how certain factors occurring in the public procurement process affect the inclusion of green award criteria within MEAT evaluation. By focusing our empirical research on the countries of the Visegrad Group, we believe its findings provide valuable insight into the uptake patterns of the green award criteria in a regional context and thus contribute to the current literature.

The results revealed that the green award criteria mostly focus on waste prevention and emission reduction, often combined with other environmental criteria to specify the environmental requirements in more detail. The relatively low uptake of green award criteria in construction works contracts suggests that green requirements are included instead in other tender documents, e.g., selection criteria or contract performance clauses (Testa et al., 2016). However, the importance of the construction sector thus calls for further research focusing on green aspects implementation at various procurement stages of public construction projects.

Generally, the uptake of green award criteria revealed in this paper corresponds to prior findings by Rosell (2021) or Nemeč et al. (2021). Their estimates suggest the approximately 2-3 per cent occurrence of green criteria within MEAT evaluation by contracting authorities in the V4 countries. More important, by focusing on the contracting authority, the results indicate that the position of the contracting authority in the functional and organisational structure has a significant effect on its environmental considerations within awarding public contracts. The higher rate of green award criteria adoption by authorities representing the lower or decentralised government level shows the importance of municipalities or regional governments among the key stakeholders in fulfilling sustainable development objectives on a local or regional level. Given the well-known potential of GPP to spur innovations (e.g., Alvarez & Rubicon, 2015; Brammer & Walker, 2011; Testa et al., 2012), GPP may therefore be a valuable tool for creating an innovative environment in collaboration among other actors within the regional innovation systems.

On the other hand, the findings of this paper did not take into account the size of regional or local authorities, effects of which may, according to the other author's findings, have various effects on GPP adoption (e.g. Testa et al., 2016; Michelsen & de Boer, 2009). Not to mention factors such as extensive bureaucracy, financial constraints or the need for administrative compliance, which are recognised barriers not only to adopting the green award criteria but for MEAT evaluation in general. Despite the shifting perceptions towards delivering the higher environmental value of procured goods, services and works in exchange for higher costs (Malatíneč, 2019), awarding the contracts in the V4 countries based on MEAT criteria is still relatively low (especially in the case of EU funded contracts). The dropped sample of 178,228 contracts awarded solely on the lowest price criterion indicates the procurers include the green considerations into public contracts using other, less demanding ways. Therefore, focusing on regional and local contracting authorities while considering the specificities of their institutional and economic environment could shed light on GPP practice by comprehensive analysis, including the other ways of GPP implementation and factors influencing its adoption.

From a policy perspective, setting the minimum requirements or standards to report individual contracts as "green" or "sustainable" with their clear distinction in the TED database would be beneficial. It would allow researchers and authorities on both national and EU levels to monitor and assess the GPP implementation. Nor would such a measure be associated with excessive bureaucracy on contracting

authorities, as it would initially only require a change in the forms used to send contract notices.

In addition to those mentioned, this study raises various other research questions. The most important seems to be if and to what extent are green criteria in MEAT evaluation decisive to awarding a contract or, in other words, whether green award criteria contribute to acquiring the "best environmental value for public money spent". Answering this question would benefit practitioners' decisions on choosing the way of including the environmental aspects into the public contracts.

APPENDIX

Table 6 Keywords to Identify the Green Award Criteria

Sub-category	Keyword
<i>General words</i>	environment, environmental, sustainable, sustainability, green, ecology, ecological, wildlife, environmentally friendly
<i>Waste emission and toxicity</i>	emission, EURO V, EURO VI, pollution, waste, waste prevention, waste management, CO ₂ , NOX, PM ₁₀ , PM _{2.5} , toxicity, hazardous, vegetable fats, vegetable oils, waste prevention, waste sorting, noise emissions, biodegradable, renewable, air quality, air pollution, pollutant, low-noise, carbon footprint, wastewater, greenhouse gas, organic gaseous carbon, particulate matter
<i>Resource efficiency</i>	water efficiency_consumption_effectiveness_saving, energy efficiency_consumption_effectiveness_saving, water efficiency_consumption_effectiveness_saving, gas efficiency_consumption_effectiveness_saving, fuel efficiency_consumption_effectiveness_saving, resource efficiency_consumption_effectiveness_saving, dimming, double-side printing
<i>Environmental labels</i>	ISO 14001, ISO 50001, EMS, EMAS, FSC, EPEAT, Energy Star, ecolabel, eco-label,
<i>Circular economy</i>	recycle, recycling, recycled, recyclable, lifetime, whole life cost, lifecycle cost, life-cycle costs, longevity, repairable, repairability, rechargeable, endurance, replacement, end-of-life, reused, reusable, dismantling, dismantle, waste recovery, LCC, LCA, TCO, lifespan, take back, operating costs

Table 7 Descriptive Statistics of Variables

	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>SK mean</i>	<i>CZ mean</i>	<i>PL mean</i>	<i>HU mean</i>
<i>EPI rank</i>	40.13	24	50	25.36	28.64	41.35	33.31
<i>Government size (revenues per % GDP)</i>	41.70	39	46.5	41.90	40.28	41.51	45.98
<i>Contract value</i>	358,559	100.02	9.85e+07	2,265,337	910,365	252,395	1,364,873
<i>GPP</i>	0.0238	0	1	0.10	0.0400	0.0188	0.0827
Government level							
<i>National government authority</i>	0.0522	0	1	0.3113	0.2260	0.0391	0.0726
<i>National agency</i>	0.0132	0	1	0.0363	0.0906	0.0010	0.0106
<i>Regional or local authority</i>	0.0729	0	1	0.0886	0.1662	0.0661	0.0849
<i>Sectoral authority</i>	0.0175	0	1	0.1159	0.0199	0.0106	0.1233
<i>Body governed by public law</i>	0.3989	0	1	0.1545	0.2869	0.4144	0.2784
<i>Other contracting body</i>	0.4317	0	1	0.2863	0.1515	0.4527	0.3876
<i>Regional or local agency</i>	0.0132	0	1	0.0068	0.0586	0.0100	0.0422
<i>Government Procurement Agreement</i>	0.2383	0	1	0.5522	0.7179	0.1780	0.6804
<i>Central purchasing body</i>	0.0074	0	1	0.2181	0.0566	0.0023	0.0299
<i>Joint procurement</i>	0.0119	0	1	0.0340	0.0113	0.0103	0.0380
<i>Framework agreement</i>	0.0460	0	1	0.3386	0.3194	0.0134	0.2663
<i>EU funds</i>	0.1127	0	1	0.3818	0.2792	0.1000	0.2792
<i>Open procedure</i>	0.9727	0	1	0.7500	0.8344	0.9846	0.9340
Type of contract							
<i>Works</i>	0.0318	0	1	0.0431	0.0407	0.0225	0.1615
<i>Supplies</i>	0.7429	0	1	0.5750	0.4921	0.7738	0.5199
<i>Services</i>	0.2253	0	1	0.3818	0.4670	0.2035	0.3185
Function of government							
<i>General public services</i>	0.2256	0	1	0.6681	0.4856	0.1854	0.5683
<i>Defence</i>	0.0205	0	1	0.0090	0.0111	0.0213	0.0177
<i>Public order and safety</i>	0.0222	0	1	0.0363	0.0532	0.0202	0.0211
<i>Economic affairs</i>	0.0067	0	1	0.0522	0.0208	0.0051	0.0159
<i>Environmental protection</i>	0.0248	0	1	0.0159	0.0111	0.0268	0.0078
<i>Housing and community amenities</i>	0.0051	0	1	0	0.0004	0.0057	0
<i>Health</i>	0.6061	0	1	0.0386	0.1976	0.6637	0.1479
<i>Recreation, culture and religion</i>	0.0049	0	1	0.0181	0.0071	0.0034	0.0249
<i>Education</i>	0.0662	0	1	0.0477	0.1900	0.0575	0.0774
<i>Social protection</i>	0.0013	0	1	0.0008	0.0035	0.0010	0.0045
<i>Electricity</i>	0.0034	0	1	0.0002	0.0062	0.0022	0.0185
<i>Water</i>	0.0036	0	1	0	0.0001	0.0015	0.0381
<i>Gas and heat</i>	0.0029	0	1	0.0023	0.0010	0.0028	0.0046
<i>Public transport</i>	0.0030	0	1	0.0143	0.0050	0.0014	0.0236
<i>Railway services</i>	0.0033	0	1	0.1000	0.0045	0.0013	0.0289
<i>Airport services</i>	0.0002	0	1	0	0.0021	0.0001	0.0001
<i>Port-related services</i>	0.0001	0	1	0	0	0.0002	0

Table 8 Estimation Results with Interaction Terms Between the Level of Government and Contract Value

Variable	Model III
<i>The EPI rank</i>	0.1086*** (0.0029)
<i>Government size</i>	0.3186*** (0.0489)
<i>Estimated contract value (log)</i>	0.1164*** (0.0229)
Government level (National as default)	
<i>National agency</i>	0.0348 (0.4408)
<i>Regional or local authority</i>	-3.2801*** (0.3663)
<i>Regional or local agency</i>	- 1.2707** (0.5210)
<i>Sectoral contracting authority</i>	- 7.5946*** (0.8110)
<i>Body governed by public law</i>	- 1.7994*** (0.3481)
<i>Other contracting authority</i>	- 2.4471*** (0.3245)
Estimated contract value*Government level (National as default)	
<i>National agency</i>	0.03670 (0.0366)
<i>Regional or local authority</i>	0.3270*** (0.0298)
<i>Regional or local agency</i>	0.1848*** (0.0431)
<i>Sectoral contracting authority</i>	0.4925*** (0.0516)
<i>Body governed by public law</i>	0.1402*** (0.0289)
<i>Other contracting authority</i>	0.1941*** (0.0269)
<i>GPA</i>	- 0.0605 (0.0387)
<i>Central purchasing body</i>	0.9037*** (0.1035)
<i>Joint procurement</i>	0.5462*** (0.0811)
<i>Framework Agreement</i>	- 0.3386*** (0.0687)
<i>Open procedure</i>	0.7930*** (0.1049)
<i>EU funds</i>	- 0.3453*** (0.0467)

Table 8 Estimation Results with Interaction Terms Between the Level of Government and Contract Value Continued

<i>Variable</i>	<i>Model III</i>
<i>Type of contract (Works as default)</i>	
<i>Supplies</i>	1.1867*** (0.0769)
<i>Services</i>	1.2640*** (0.0741)
<i>Constant</i>	- 19.275*** (1.990)
<i>Country FE</i>	Yes
<i>Function of government FE</i>	Yes
<i>Log pseudolikelihood</i>	- 17417.2
<i>Pseudo R2</i>	0.1916
<i>AIC</i>	34916.39
<i>Observations</i>	191,189

Notes: *** p < 0.01; ** p < 0.05; * p < 0.1; robust std. errors in parentheses

Table 9 Robustness Checks

<i>Variable</i>	<i>Model A (GW)</i>	<i>Model B (A+EL)</i>	<i>Model C (B+WET)</i>	<i>Model D (C+RC)</i>
Country Variables				
<i>The EPI rank</i>	0.0122*** (0.0043)	0.0138*** (0.0043)	0.0074*** (0.0033)	0.0097*** (0.0031)
<i>Government size</i>	0.9061*** (0.1213)	0.8812*** (0.1187)	0.6024*** (0.0868)	0.3609*** (0.0640)
Contracting authority variables				
Level of Government (National government body as default)				
<i>National agency</i>	0.0049 (0.2099)	- 0.7363 (0.2074)	- 0.0436 (0.1461)	0.1158 (0.1258)
<i>Regional or local authority</i>	0.1302 (0.1577)	0.1619 (0.1145)	0.6169*** (0.0768)	0.7100*** (0.0726)
<i>Regional or local agency</i>	0.7771*** (0.1475)	0.8376*** (0.1471)	0.8878*** (0.1161)	0.8477*** (0.1094)
<i>Sectoral contracting authority</i>	- 1.0829** (0.5146)	- 1.0799** (0.5137)	- 1.1915*** (0.4290)	- 0.8776** (0.3733)
<i>Body governed by public law</i>	- 0.3501*** (0.1190)	- 0.2065* (0.1195)	- 0.2142** (0.0858)	- 0.1074 (0.0804)
<i>Other contracting authority</i>	0.0257 (0.1010)	0.1260 (0.1095)	- 0.2297*** (0.0771)	- 0.1209* (0.0729)
<i>GPA</i>	- 0.2823*** (0.0633)	- 0.2193*** (0.0610)	- 0.2489*** (0.0464)	- 0.1036** (0.0419)
<i>Central purchasing body</i>	- 2.3666*** (0.5283)	- 2.0014*** (0.4358)	0.0559 (0.1584)	0.6818*** (0.1317)
Contract variables				
<i>Estimated contract value (log)</i>	0.2414*** (0.0132)	0.2493*** (0.0609)	0.3236*** (0.0099)	0.3005*** (0.0091)
<i>Joint procurement</i>	0.8355*** (0.0967)	0.8216*** (0.0955)	0.7601*** (0.0849)	0.7135*** (0.0814)
<i>Framework Agreement</i>	0.0284 (0.0942)	- 0.0010 (0.0928)	- 0.4081*** (0.0839)	- 0.5897*** (0.0814)
<i>Open procedure</i>	0.7007*** (0.1728)	0.6261*** (0.1671)	0.9099** (0.1378)	0.6303*** (0.1114)
<i>EU funds</i>	- 0.1117 (0.0692)	- 0.1617*** (0.0678)	- 0.6791*** (0.0576)	- 0.5265*** (0.0518)
Type of contract (Works as default)				
<i>Supplies</i>	- 0.7367*** (0.0947)	- 0.4653*** (0.0911)	0.4955*** (0.0789)	0.7824*** (0.0741)
<i>Services</i>	0.5717*** (0.0747)	0.5603*** (0.0740)	1.1491*** (0.0699)	1.0893*** (0.0689)
<i>Constant</i>	- 47.068*** (5.0046)	- 46.098*** (4.9013)	- 34.957*** (3.5038)	- 3.585*** (2.5725)
<i>Country FE</i>	Yes	Yes	Yes	Yes
<i>Function of government FE</i>	Yes	Yes	Yes	Yes
<i>Log pseudolikelihood</i>	- 8094.78	- 8644.90	- 13189.22	- 15205.91
<i>Pseudo R2</i>	0.2004	0.1874	0.2365	0.2073
<i>AIC</i>	16259.56	17539.82	26448.45	30481.83
<i>Observations</i>	191189	191189	191189	191189

Notes: *** p < 0.01; ** p < 0.05; * p < 0.1; robust std. errors in parentheses

REFERENCES:

- Alvarez S, Rubicon A (2015): Carbon Footprint in Green Public Procurement: A Case Study in the Services Sector. *Journal of Cleaner Production*, 93:159–166. <https://doi.org/10.1016/j.jclepro.2015.01.048>
- Appolloni A, Coppola MA, Piga G (2019): Implementation of Green Considerations in Public Procurement: A Means to Promote Sustainable Development. *Green Public Procurement Strategies for Environmental Sustainability*, pp. 23–44, IGI Global.
- Badell D, Rosell J (2021): Are EU Institutions Still Green Actors? An Empirical Study of Green Public Procurement. *Journal of Common Market Studies*, 1–18. <https://doi.org/10.1111/jcms.13204>
- Bauhr M, Czibik Á, de Fine Licht J, Fazekas M (2020): Lights on the Shadows of Public Procurement: Transparency as an Antidote to Corruption. *Governance*, 33(3):495–523.
- Bauer B, Fischer-Bogason R, Boer L De, Kivistö T, Vildåsen S (2016): *Greening State Framework Contracts – Approaches in the Nordic Countries. Summary report*. 20.
- Boix C (2001): *Democracy, Development, and the Public Sector*. *American Journal of Political Science*, 45(1):1–17. <https://doi.org/10.2307/2669356>
- Bouwer M, de Jong K, Jonk M, Berman T, Bersani R, Lusser H, Nissinen A, Parikka K, Szuppinger P (2006): *Green Public Procurement in Europe 2006. Conclusions and recommendations*. Haarlem: Virage.
- Brammer S, Walker H (2011): Sustainable Procurement in the Public Sector: An International Comparative Study. *International Journal of Operations and Production Management*, 31(4):452–476. <https://doi.org/10.1108/01443571111119551>
- Bush J (2020): The Role of Local Government Greening Policies in the Transition towards Nature-Based Cities. *Environmental Innovation and Societal Transitions*, 35(February):35–44. <https://doi.org/10.1016/j.eist.2020.01.015>
- Burns LR (2014): The Performance of Group Purchasing Organizations (GPOs) in the Health Care Value Chain: A Literature Review. *Department of Health Care Management, The Wharton School, University of Pennsylvania, Philadelphia*
- Cheng W, Appolloni A, D’Amato A, Zhu Q (2018): Green Public Procurement, Missing Concepts and Future Trends – A critical review. *Journal of Cleaner Production*, 176:770–784. <https://doi.org/10.1016/j.jclepro.2017.12.027>
- Cox DR (1958): The Regression Analysis of Binary Sequences. *Journal of the Royal Statistical Society: Series B (Methodological)*, 20(2):215–232. <https://doi.org/10.1111/j.2517-6161.1958.tb00292.x>
- Diófási O, Valkó L (2014): Step by Step towards Mandatory Green Public Procurement. *Periodica Polytechnica Social and Management Sciences*, 22(1):21–27. <https://doi.org/10.3311/PPso.2151>
- Directorate-General for Internal Market, I. E. and Sme. (2015): *Tenders Electronic Daily (TED) (csv subset) – public procurement notices - Datasets*. In *EU Open Data Portal*. <https://data.europa.eu/euodp/en/data/dataset/ted-csv>
- Džupka P, Kubák M, Nemeč P (2020): Sustainable Public Procurement in Central European Countries. Can It Also Bring Savings? *Sustainability (Switzerland)*, 12(21):1–13. <https://doi.org/10.3390/su12219241>
- EU (2016): *Buying Green! - A Handbook on Green Public Procurement - 3rd edition*. *European Union*. <https://doi.org/10.2779/246106>
- European Commission (2008): *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Public Procurement for a Better Environment*. <http://library1.nida.ac.th/termpaper6/sd/2554/19755.pdf>
- European Commission (2014): *Public Procurement Reform Factsheet No. 7: Green Public Procurement*. 7:1–2.

European Commission (2015): *Strategic Use of Public Procurement in Promoting Green, Social and Innovation Policies*.

European Commission (2017): *European Semester Thematic Factsheet Public Procurement*. 1–12.

European Commission (2021): *Open Data Portal for the European Structural Investment Funds - European Commission | Data | European Structural and Investment Funds*. <https://cohesiondata.ec.europa.eu/overview>

European Parliament (2014): Directive 2014/24/EU of The European Parliament and of The Council of 26 February 2014 on Public Procurement and Repealing Directive 2004/18/EC (Text with EEA relevance). *Official Journal of the European Union*, 94/65, 65–242. <https://doi.org/10.5040/9781509923205.0008>

European Union (2021): *About TED - TED Tenders Electronic Daily*. Retrieved February 12, 2021, from <https://ted.europa.eu/TED/misc/aboutTed.do>

European Union (2020): *TED CSV open data Notes and Codebook*. <https://data.europa.eu/euodp/en/data/dataset/ted-csv/resource/99798664-6cf7-4429-b53c-4ecac59f1b6a>

Eurostat (2019): *Glossary: Classification of the Functions of Government (COFOG)*. In *Statistics Explained*. [https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Classification_of_the_functions_of_government_\(COFOG\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Classification_of_the_functions_of_government_(COFOG))

Faes W, Matthyssens P, Vandenbempt K (2000): The Pursuit of Global Purchasing Synergy. *Industrial Marketing Management*, 29(6):539–553. [https://doi.org/10.1016/S0019-8501\(00\)00127-9](https://doi.org/10.1016/S0019-8501(00)00127-9)

Fazekas M (2017): Assessing the Quality of Government at the Regional Level Using Public Procurement Data. *DG for Regional Policy: Working Papers* https://ec.europa.eu/regional_policy/sources/docgener/work/201703_regional_pp_governance.pdf

Fazekas M, King LP (2019): Perils of Development Funding? The Tale of EU Funds and Grand Corruption in Central and Eastern Europe. *Regulation and Governance*, 13(3):405–430. <https://doi.org/10.1111/rego.12184>

Foray D (2014): *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Routledge.

Grandia J (2015): Implementing Sustainable Public Procurement. *Radboud Repository*. <http://repository.ubn.ru.nl/bitstream/handle/2066/93611/93611.pdf?sequence=1>

Grandia J (2016): Finding the Missing Link: Examining the Mediating Role of Sustainable Public Procurement Behaviour. *Journal of Cleaner Production*, 124:183–190. <https://doi.org/10.1016/j.jclepro.2016.02.102>

Günther E, Scheibe L (2006): The Hurdle Analysis. A Self-Evaluation Tool for Municipalities to Identify, Analyse and Overcome Hurdles to Green Procurement. *Corporate Social Responsibility and Environmental Management*, D(March), 61–77. <https://doi.org/10.1002/csr.92>

Hoekman B, Taş BKO (2020): Procurement Policy and SME Participation in Public Purchasing. *Small Business Economics*. <https://doi.org/10.1007/s11187-020-00414-z>

Hsu A, Zomer A (2014): Environmental Performance Index. *Wiley StatsRef: Statistics Reference Online*, 1-5.

Igarashi M, De Boer L, Michelsen O (2015): Investigating the Anatomy of Supplier Selection in Green Public Procurement. *Journal of Cleaner Production*, 108, 442–450. <https://doi.org/10.1016/j.jclepro.2015.08.010>

Karjalainen K (2011): Estimating the Cost Effects of Purchasing Centralization-Empirical Evidence from Framework Agreements in the Public Sector. *Journal of Purchasing and Supply Management*, 17(2):87–97. <https://doi.org/10.1016/j.pursup.2010.09.001>

Klugman J (2013): Decentralisation: A Survey of Literature from a Human Development Perspective. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2294658>

Kozik R, Karasiska-Jakowiec I (2016): Green Public Procurement-Legal Base and Instruments

- Supporting Sustainable Development in the Construction Industry in Poland. *E3S Web of Conferences*, 10. <https://doi.org/10.1051/e3sconf/20161000044>
- Kubák M, Nemeč P, Vološin M (2021): On the Competition and Transparency in Public Procurement During COVID-19 Pandemic in European Union. *Kubak, Matus and Nemeč, Peter and Vološin, Marcel, On the Competition and Transparency in Public Procurement During COVID-19 Pandemic in European Union (March 26, 2021)*. <http://dx.doi.org/10.2139/ssrn.3812924>
- Kunzlik P (2013): Green Public Procurement- European Law, Environmental Standards and 'what to Buy' Decisions. *Journal of Environmental Law*, 25(2), 173–202. <https://doi.org/10.1093/jel/eqt006>
- Kutlina-Dimitrova Z, Lakatos C (2016): Determinants of Direct Cross-Border Public Procurement in EU Member States. *Review of World Economics*, 152(3):501–528. <https://doi.org/10.1007/s10290-016-0251-3>
- Ladi S, Tsarouhas D (2017): International Diffusion of Regulatory Governance: EU Actorness in Public Procurement. *Regulation and Governance*, 11(4):388–403. <https://doi.org/10.1111/rego.12163>
- Lundberg S, Marklund P-O (2013): Green Public Procurement as an Environmental Policy Instrument: Cost Effectiveness. *Environmental Economics*, 4(4):75–83.
- Lundberg S, Marklund PO, Strömbäck E, Sundström D (2015): Using Public Procurement to Implement Environmental Policy: an Empirical Analysis. *Environmental Economics and Policy Studies*, 17(4):487–520. <https://doi.org/10.1007/s10018-015-0102-9>
- Malatincec T (2019): Attitudes of Europeans Towards Green Products. *Economy of Region*, 15(1):99–106. <https://doi.org/10.17059/2019-1-8>
- Michelsen O, de Boer L (2009): Green Procurement in Norway; a Survey of Practices at the Municipal and County Level. *Journal of Environmental Management*, 91(1):160–167. <https://doi.org/10.1016/j.jenvman.2009.08.001>
- Nemeč J, Kubák M, Krapek M, Horehajova M (2020): Competition in Public Procurement in the Czech and Slovak Public Health Care Sectors. *Healthcare*, 8(3):201. <https://doi.org/10.3390/healthcare8030201>
- Nemeč J, Kubák M, Donin G, Kotherova Z (2021): Efficiency of Public Procurement in the Czech and Slovak Health Care Sectors. *Transylvanian Review of Administrative Sciences* (62). <http://dx.doi.org/10.24193/tras.62E.7>
- Nemeč P, Kubák M, Džupka P (2021): The Transition of the Visegrad Countries Toward Sustainable Public Procurement. *Eastern European Economics*, 59(5):487-512. <https://doi.org/10.1080/00128775.2021.1956973>
- Nikolaou IE, Loizou C (2015): The Green Public Procurement in the Midst of the Economic Crisis: Is it a Suitable Policy Tool? *Journal of Integrative Environmental Sciences*, 12(1):49–66. <https://doi.org/10.1080/1943815X.2014.993657>
- Nissinen A, Parikka-Alhola K, Rita H (2009): Environmental Criteria in the Public Purchases above the EU Threshold Values by Three Nordic Countries: 2003 and 2005. *Ecological Economics*, 68(6):1838–1849. <https://doi.org/10.1016/j.ecolecon.2008.12.005>
- OECD (2011a): *Public Procurement for Sustainable and Inclusive Growth*. OECD Publishing, 1–18.
- OECD (2011b): Setting the Award Criteria, Public Procurement Brief 8. *Public Procurement Brief 8, January*. http://www.sigmaxweb.org/publications/SettingtheAwardCriteria_Brief8_2011.pdf
- OECD (2019): *Making Decentralisation Work*. <https://doi.org/https://doi.org/https://doi.org/10.1787/g2g9faa7-en>
- OECD (2020): Central Purchasing Bodies. Government at a Glance. Retrieved February 20, 2021 from <https://www.oecd-ilibrary.org/sites/c9a25f21-en/index.html?itemId=/content/component/c9a25f21-en>

- OECD (2021a): *Government at a Glance 2021*. OECD Publishing, Paris. Retrieved August, 2022 from <https://doi.org/10.1093/oso/9780190645410.003.0002>
- OECD (2021b): Strengthening Value for Money in the Public Procurement System of the Slovak Republic: Towards a Strategy to Use Adequate Award Criteria. *OECD Public Governance Policy Papers*, No. 08, OECD Publishing, Paris, <https://doi.org/10.1787/9b4deebd-en>.
- OECD (2021c): Promoting Research And Innovation in the Slovak Republic through an Effective Use of European funds. *OECD Public Governance Policy Papers*, No. 04, OECD Publishing, Paris, <https://doi.org/10.1787/f0e9d786-en>
- Parikka-Alhola K, Nissinen A, Ekroos A (2006): Green Award Criteria in the Most Economically Advantageous Tender in Public Purchasing. *Advancing Public Procurement*, 257–279.
- Parikka-Alhola K, Nissinen A (2012): Environmental Impacts and the Most Economically Advantageous Tender in Public Procurement. *Journal of Public Procurement*, 12(1):43–80.
- Plaček M (2017): The Effects of Decentralization on Efficiency in Public Procurement: Empirical Evidence for the Czech Republic. *Lex Localis*, 15(1):67–92. [https://doi.org/10.4335/15.1.67-92\(2017\)](https://doi.org/10.4335/15.1.67-92(2017))
- Plaček M, Nemeč J, Ochrana F, Schmidt M, Půček M (2020): Analysis of Factors of Overpricing in Public Procurement: A Study for Low-performing EU Countries. *International Journal of Public Administration*, 43(4):350–360. <https://doi.org/10.1080/01900692.2019.1636393>
- Plaček M, Valentínov V, del Campo C, Vaceková G, Ochrana F, Šumpíková M (2021): Stewardship and Administrative Capacity in Green Public Procurement in the Czech Republic: evidence from a large-N survey. *Environmental Sciences Europe*, 33(1). <https://doi.org/10.1186/s12302-021-00534-7>
- Plebankiewicz E, Kozik R (2017): The Transformation of the Tender Evaluation Process in Public Procurement in Poland. *IOP Conference Series: Materials Science and Engineering*, 251(1). <https://doi.org/10.1088/1757-899X/251/1/012042>
- Pouikli K (2020): Towards Mandatory Green Public Procurement (GPP) Requirements under the EU Green Deal: Reconsidering the Role of Public Procurement as an Environmental Policy Tool. *ERA Forum*, 699–721. <https://doi.org/10.1007/s12027-020-00635-5>
- Preuss L (2009): Addressing Sustainable Development through Public Procurement: The case of Local Government. *Supply Chain Management*, 14(3):213–223. <https://doi.org/10.1108/13598540910954557>
- Renda A, Pelkmans J, Egenhofer C, Schrefler L (2012): *The Uptake of Green Public Procurement in the EU27*. <https://ec.europa.eu/environment/gpp/pdf/CEPS-CoE-GPP%20MAIN%20REPORT.pdf>
- Rietbergen MG, Blok K (2013): Assessing the Potential Impact of the CO2 Performance Ladder on the Reduction of Carbon Dioxide Emissions in the Netherlands. *Journal of Cleaner Production*, 52:33–45. <https://doi.org/10.1016/j.jclepro.2013.03.027>
- Rosell J (2021): Getting the Green Light on Green Public Procurement: Macro and Meso Determinants. *Journal of Cleaner Production*, 279, 123710. <https://doi.org/10.1016/j.jclepro.2020.123710>
- Schebesta H (2018): Revision of the EU Green Public Procurement Criteria for Food Procurement and Catering Services - Certification Schemes as the Main Determinant for Public Sustainable Food Purchases? *European Journal of Risk Regulation*, 9(2):316–328. <https://doi.org/10.1017/err.2018.24>
- Schotanus F, Telgen J, de Boer L (2010): Critical Success Factors for Managing Purchasing Groups. *Journal of purchasing and supply management*, 16(1):51–60.
- Sönnichsen SD, Clement J (2020): Review of Green and Sustainable Public Procurement: Towards Circular Public Procurement. *Journal of Cleaner Production*, 245. <https://doi.org/10.1016/j.jclepro.2019.118901>
- Stake J (2017): Evaluating Quality or Lowest Price: Consequences for Small and Medium-Sized

- Enterprises in Public Procurement. *Journal of Technology Transfer*, 42(5):1143–1169. <https://doi.org/10.1007/s10961-016-9477-4>
- Strengers Y (2004): Environmental Culture Change in Local Government: A Practised Perspective from the International Council for Local Environmental Initiatives - Australia/New Zealand. *Local Environment*, 9(6):621–628. <https://doi.org/10.1080/1354983042000288102>
- Tas BKO (2020): Effect of Public Procurement Regulation on Competition and Cost-Effectiveness. *Journal of Regulatory Economics*, 58(1):59–77. <https://doi.org/10.1007/s11149-020-09409-w>
- Testa F, Annunziata E, Iraldo F, Frey M (2016): Drawbacks and Opportunities of Green Public Procurement: An Effective Tool for Sustainable Production. *Journal of Cleaner Production*, 112:1893–1900. <https://doi.org/10.1016/j.jclepro.2014.09.092>
- Testa F, Grappio P, Gusmerotti NM, Iraldo F, Frey M (2016): Examining Green Public Procurement Using Content Analysis: Existing Difficulties for Procurers and Useful Recommendations. *Environment, Development and Sustainability*, 18(1):197–219. <https://doi.org/10.1007/s10668-015-9634-1>
- Testa F, Iraldo F, Frey M, Daddi T (2012): What Factors Influence the Uptake of GPP (Green Public Procurement) Practices? New Evidence from an Italian Survey. *Ecological Economics*, 82:88–96. <https://doi.org/10.1016/j.ecolecon.2012.07.011>
- The World Bank Group (2016): *Benchmarking Public Procurement 2017*. <https://doi.org/10.1596/32500>
- The World Bank Group. (2019). GDP, PPP. Retrieved Jun 5, 2021, from: https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?most_recent_value_desc=true%0Ahttps://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?name_desc=false%0Ahttps://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?most_recent_value_desc=true%0Ahttps://data
- Thijs N, Hammerschmid G, Palaric E (2017): *A Comparative Overview of Public Administration Characteristics and Performance in EU28*. European Commission, Brussels.
- Tsai WT (2017): Green Public Procurement and Green-Mark Products Strategies for Mitigating Greenhouse Gas Emissions—Experience from Taiwan. *Mitigation and Adaptation Strategies for Global Change*, 22(5):729–742. <https://doi.org/10.1007/s11027-015-9695-3>
- United Nations (2008): Public Procurement as a Tool for Promoting More Sustainable Consumption and Production Patterns. *Sustainable Development Innovation Briefs*, 5:1–4. <https://sustainabledevelopment.un.org/content/documents/no5.pdf>
- Uttam K, Le Lann Roos C (2015): Competitive Dialogue Procedure for Sustainable Public Procurement. *Journal of Cleaner Production*, 86, 403–416. <https://doi.org/10.1016/j.jclepro.2014.08.031>
- Wendling ZA, Emerson JW, Esty DC, Levy MA, de Sherbinin A et al. (2018). 2018 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy. <https://epi.yale.edu/>
- Wendling ZA, Emerson JW, de Sherbinin A, Esty DC et al. (2020): *Environmental Performance Index*. New Haven: Yale Center for Environmental Law & Policy. Retrieved Jun 7, 2021 from: epi.yale.edu
- Wilson E, Vihlová D (2000): The Role of Local Government in Environmental Action in Slovakia. *Local Environment*, 5(3):255–269.
- WTO (2015): *WTO | Government procurement - The plurilateral Agreement on Government Procurement (GPA)*. Retrieved June 7, 2021, from https://www.wto.org/english/tratop_e/gproc_e/gp_gpa_e.htm
- Yu C, Morotomi T, Yu H (2020): What Influences Adoption of Green Award Criteria in a Public Contract? An Empirical Analysis of 2018 European Public Procurement Contract Award Notices. *Sustainability (Switzerland)*, 12(3). <https://doi.org/10.3390/su12031261>